UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/516,322	02/15/2005	Martin Henrich	04233	3868

23338 7590 07/22/2008
DENNISON, SCHULTZ & MACDONALD
1727 KING STREET
SUITE 105
ALEXANDRIA, VA 22314

EXAMINER	
SYKES, ALTREV C	

ART UNIT	PAPER NUMBER
1794	

MAIL DATE	DELIVERY MODE
07/22/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/516,322	HENRICH ET AL.	
	Examiner	Art Unit	
	ALTREV C. SYKES	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on 5 May 2008.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-58 is/are pending in the application.

4a) Of the above claim(s) 1-29 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 30-58 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 05 May 2008 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed May 5, 2008 is acknowledged and accepted by examiner. It is noted that applicant has canceled claims 1-29. Additionally, applicant has added new claims 30-58 for examination on the merits.

2. Applicant's arguments with respect to Krenkel et al. rejection have been considered but are moot in view of the new ground(s) of rejection. However, Applicant's arguments regarding the secondary and tertiary references Mattheij et al., Bilisik et al., and Hecht have been fully considered but they are not persuasive.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). Mattheij et al. uses an embroidery technique where rovings providing in-plane reinforcement are fixed on a base material moving in the *x,y*-direction using zigzag stitching. Hect teaches needlepunching operations wherein a portion of the filaments making up the mat will be caught by the barbs and reoriented as filament bundles in the z or thickness direction. The portion of the filaments not caught by the barbs will be displaced laterally within the x-y plane by the needles. (See Col 12, lines 24-26) Finally, Bilisik discloses a three-

dimensional multiaxial circular woven fabric for use as a preform that can be constructed with fiber content in each direction of the preform that is tailored to correspond to the required properties of the preform using a technique that is substantially either the same or equivalent to that of the TFP preform of Mattheij et al. (See Col 2, lines 23-28) Furthermore, to use the embroidery stitching method of the TFP preform would have been obvious at the time of the claimed invention for anyone choosing series and mass production of three dimensionally reinforced composites for braking systems.

In conclusion, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. In re Keller, 642 F.2d 413, 208USPQ 871 (CCPA 1981); In re Merck & Co., Inc., 800 F.2d 1091, 231 USPQ 375(Fed. Cir. 1986).

Drawings

3. The drawings were received on May 5, 2008. These drawings are accepted by examiner.

Specification

4. The disclosure is objected to because of the following informalities: In the amendment filed May 5, 2008 the applicant amended the specification on page 8, to now replace the reference number 16 with the reference number 18 required by Figure 1. However, on page 8, lines 15-25, reference number 16 and 18 both are listed as describing tangential fibers. It is unclear to examiner which is appropriate since Figure 1 necessitates a description for both.

Appropriate correction is required.

Also, applicant amended the specification on pg. 12, lines 6-14 for Figures 4 and 5. This appears to be an error since the reference numbers of 60, 62, 64, etc. are not labeled in the those figures but are labeled for Figures 6 and 7.

Appropriate correction is required.

The correction of TOP to TFP (technology) has been noted and is accepted by examiner.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 45 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 45, the limitation "the reinforcing fibers extend in a layer extending from their central opening tangentially thereof' renders the claim indefinite because it is unclear from where or from what the central opening extends. See MPEP § 2173.05(d).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 30, 31, 33-37, 39-41, 47, 51, 53-56, and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duval et al. (US 6,183,583) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement)

Regarding claim 30, Duval et al. discloses manufacturing parts made of carbon-carbon composite material (C-C), in particular to manufacturing brake disks. (See Col 1, lines 5-7) Parts made of C-C composite material are manufactured by making a fiber preform of a shape that is close to that of the part to be manufactured (i.e. annular) and by densifying the preform by inserting a matrix into the pores of the preform. The preform is made from a base fiber fabric, for example by winding a strip of base fabric in superposed layers or by stacking or laying plies of base fabric and then needling. (See Col 1, lines 15-21 and Col 2, lines 7-12) Duval discloses supplying a basic fiber fabric in the form of a felt made of carbon or carbon precursor fibers; supplying a three-dimensional fiber structure by superposing and needling layers of felt; compressing the structure to obtain a preform of a shape that is close to that of the brake disk to be made; holding the preform in the compressed state by consolidation after it has been impregnated with a liquid composition containing a bonding agent; densifying the

preform, e.g. at least in part by chemical vapor infiltration, or some other densification technique; and machining the densified preform to obtain the desired brake disk. (See Col 4, lines 25-41) Other known densification techniques can be used, for example the liquid technique or a gas infiltration technique based on vaporizing a liquid precursor in which the heated preform is immersed. (See Col 8, lines 42-45)

Duval et al. discloses all of the claim limitations as set forth above but the reference does not disclose, the stitching using TFP of the reinforcing fibers and the base layer.

Mattheij et al. teaches a preform made of carbon reinforced fibers wherein said preform is made using a manufacturing technique wherein preforms can be tailored for a specific composite component. (See pg 571). Local fiber orientation as well as local fiber content can be varied. Mattheij et al. uses an embroidery technique where rovings providing in-plane reinforcement are fixed on a base material moving in the *x,y*-direction using zigzag stitching. This TFP preform is disclosed as resulting in a great variety of textile structures with stress field aligned fiber placement, 3D-reinforced preforms (full or partial), and deep-drawable preforms. Additionally, these TFP preforms allow for processing of natural, glass, aramid, carbon and ceramic fibers which provides for maximum exploitation of reinforcing fibers through uniformly stressed fibers in the composite and near-net-shape production (no cutting, low waste). (See Sect. I., pg. 571) Further the production costs are lowered because of the use of rovings and the high degree of automation making it attractive for series production of preforms for advanced composite parts. (See Sect. I., pg. 571)

As Duval et al. and Mattheij both teach needling/stitching three-dimensional fiber structures, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art to use the manufacturing TFP process as taught by Mattheij in place of the needling as disclosed by Duval et al., for the purpose of producing a preform with stress field aligned fiber placement, 3D-reinforced preforms (full or partial), or deep-drawable preforms all of which are capable of lower production costs thereby obtaining a woven preform of complex shape having improved torsional and shear properties.

Claim 30 is a product-by-process claim. Absent a showing to the contrary, it is the examiner's position that the article of the applied prior art is identical to or only slightly different than the claimed article. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985). The burden has been shifted to the applicant to show unobvious difference between the claimed product and the prior art product. *In re Marosi*, 218 USPQ 289 (Fed. Cir. 1983). The applied prior art either anticipated or strongly suggested the claimed subject matter. It is noted that if the applicant intends to rely on Examples in the specification or in a submitted declaration to show non-obviousness, the applicant should clearly state how the Examples of the present invention are commensurate in scope with the claims and how the Comparative Examples are commensurate in scope with the applied prior art. In

the instant case, Duval et al. discloses after compression, the resin can be polymerized by heating. Once the resin has polymerized, the consolidated preform is withdrawn from the molding. Thereafter, carbonization heat treatment is performed on the consolidated preform to carbonize the resin. (See Col 8, lines 17-26) the preform is then densified at least in part. (See Col 8, lines 38-41) As applicant did not provide a required order for the structure steps, it is noted by examiner that all limitations of the claim have been met by Duval et al. product.

As the structure and materials of modified Duval et al. have been shown to be similar to that of the structure and materials as claimed by Applicant, it is presumed that the prior art can do whatever is claimed since the similarity is substantial. As such, it is noted that the modified composite of Duval et al. is also capable of being stressed and/or containing stressable fibers.

Regarding claim 31, modified Duval et al. discloses all of the claim limitations as set forth above.

Additionally, Duval et al. discloses a fiber composite component wherein the preform is densified at least in part, or densification is continued, by chemical vapor infiltration in a manner that is well known per se, causing a matrix of pyrolytic carbon to be deposited in addition to the resin coke. (See Col 8, lines 38-45)

Regarding claims 33 and 41, Duval et al. discloses using layers of felt and bonding them together by needling makes it possible to obtain a structure in which there is no limit on the number of directions in three dimensions in which the fibers are oriented, i.e. a structure is obtained that is genuinely three-dimensional. In addition, the

density of needling can be selected so as to transfer a sufficiently large number of fibers in the Z direction (perpendicular to the layers) to ensure that the resulting structure is of a quasi-isotropic character. (See Col 7, lines 38-46)

Regarding claim 34, Duval et al. discloses Depending on the selected method of forming the fiber structure, the felt may be presented in various forms, such as a continuous strip of greater or lesser width, full plies, or precut annular plies. (See Col 4 lines 66-67 and Col 5, lines 1-2) Various methods can be used for forming the annular three-dimensional structure, all of which comprise superposing and needling a plurality of layers of felt, the number of layers being selected as a function of the stiffness and the fiber volume fraction desired for the preform after compression. (see Col 5, lines 3-7) The felt used for implementing the method of the invention is preferably made of carbon fibers or it could be made of fibers that are a precursor of carbon. (See Col 3, lines 39-45) it is noted by examiner that Duval et al. discloses that it is possible the felts may be made of different kinds of fiber for different portions of the fiber structure. (See Col 3, lines 46-47) A statement as such, suggests to the examiner that before this modification all the felt layers of the composite are made the same.

Regarding claim 35, Duval et al. discloses holding the preform in the compressed state by consolidation after it has been impregnated with a liquid composition containing a bonding agent. (See Col 4, lines 34-35) Alternatively, injection can be performed in the molding tooling after the preform has been put into place but before compression. This is preferable when fillers are incorporated in the impregnation composition, thereby reducing its fluidity, it being easier to obtain uniform distribution

thereof within the preform when the pores of the preform are more accessible. (See Col 8, lines 10-16)

Regarding claim 36, Duval et al. discloses supplying a three-dimensional fiber structure by superposing and needling layers of felt (See Col 4, lines 28-29) Duval et al. also discloses that it is possible the felts may be made of different kinds of fiber for different portions of the fiber structure. (See Col 3, lines 46-47) The felt may be presented in various forms, such as a continuous strip of greater or lesser width, full plies, or precut annular plies. (See Col 4 lines 66-67 and Col 5, lines 1-2)

Regarding claim 37 and 40, Duval et el. discloses The felt is made in conventional manner from relatively short carbon fibers, i.e. fibers that preferably have a mean length lying in the range 10 mm to 100 mm. (See Col 4, Lines 45-47) It is noted that Duval et al. discloses manufacturing annular brake disks having required mechanical and tribological qualities. As such, it is noted by examiner that if the annular brake disks are composed of layers of felt made of the short fibers then the inside as well as the outside would be provided with short fibers.

Regarding claim 39, Duval et al. discloses To manufacture disk brakes out of C--C composite material, annular fiber preforms are generally made by needling plies of a base fiber fabric comprising a woven cloth or a laminate comprising a plurality of unidirectional sheets of yarns, tows, or strands, optionally associated with a fiber web or a felt. (See Col2, lines 7-12)

Regarding claim 47, Mattheij et al. discloses for the TFP-process, in most cases the needle thread used is a thin polyester yarn which is suited for maintaining preform

integrity until the consolidation process has ended. However, needle thread of reinforcing fibers, e.g. aramid may also be used. (See Section I. pg. 571) As such, modified Duval et al. meets the limitation.

Regarding claim 51, Duval discloses supplying a basic fiber fabric in the form of a felt made of carbon or carbon precursor fibers; supplying a three-dimensional fiber structure by superposing and needling layers of felt. (See Col 4, lines 27-31) Duval et al. disclose the layers of felt are advantageously needled one by one as they are superposed. (See Col 2, lines 66-67)

Regarding claims 53 and 56, Duval et al. discloses manufacturing disk brakes out of C-C composite material, annular fiber preforms are generally made by needling plies of a base fiber fabric comprising a woven cloth or a laminate comprising a plurality of unidirectional sheets of yarns, tows, or strands, optionally associated with a fiber web or a felt. The plies are needled one at a time so as to obtain needling of a predetermined density in the thickness of the preform. In addition, the density of needling can be selected so as to transfer a sufficiently large number of fibers in the Z direction (perpendicular to the layers) to ensure that the resulting structure is of quasi-isotropic character. (See Col 7, lines 42-46)

Regarding claims 54 and 55, it is noted by examiner that stitching would provide for force input points for the stacked layers thereby, inherently, forming a thickening of the reinforcing fibers. Further, the stacking of quasi-isotropic felt layers would provide for the reinforcing fibers being placed to cross one another in the thickening. (See Col 7, lines 38-46) Additionally, the stacking of the felt layers to form a frictional portion used

on one or both sides of the core since it is the core which transmits fiction forces. (See Col 9, lines 6-9) As such, the reinforcing fibers would also be in the area of the force input point. Duval et al. also discloses in order to obtain fiber reinforcement with carbon fibers across the thickness of the disk coming from different precursors, it is preferable to make the fiber preforms by compressing annular structures formed from stacked plies. (See Col 9, lines 18-21)

Regarding claim 58 Duval et al. discloses a method of manufacturing parts made of carbon-carbon composite material (C-C), in particular to manufacturing brake disks. (See Col 1, lines 5-7) Parts made of C-C composite material are manufactured by making a fiber preform of a shape that is close to that of the part to be manufactured (i.e. annular) and by densifying the preform by inserting a matrix into the pores of the preform. The preform is made from a base fiber fabric, for example by winding a strip of base fabric in superposed layers or by stacking or laying plies of base fabric and then needling. (See Col 1, lines 15-21 and Col 2, lines 7-12) Duval discloses supplying a basic fiber fabric in the form of a felt made of carbon or carbon precursor fibers; supplying a three-dimensional fiber structure by superposing and needling layers of felt; compressing the structure to obtain a preform of a shape that is close to that of the brake disk to be made; holding the preform in the compressed state by consolidation after it has been impregnated with a liquid composition containing a bonding agent; densifying the preform, e.g. at least in part by chemical vapor infiltration, or some other densification technique; and machining the densified preform to obtain the desired brake disk. (See Col 4, lines 25-41) Other known densification techniques can be used, for example the liquid

technique or a gas infiltration technique based on vaporizing a liquid precursor in which the heated preform is immersed. (See Col 8, lines 42-45)

Duval et al. discloses all of the claim limitations as set forth above but the reference does not disclose, the stitching using TFP of the reinforcing fibers and the base layer.

Mattheij et al. teaches a preform made of carbon reinforced fibers wherein said preform is made using a manufacturing technique wherein preforms can be tailored for a specific composite component. (See pg 571). Local fiber orientation as well as local fiber content can be varied. Using stitching, a roving providing in-plane reinforcement is fixed on a base material as the base material is moved in the *x,y*-direction. This TFP preform is disclosed as resulting in a great variety of textile structures with stress field aligned fiber placement, 3D-reinforced preforms (full or partial), and deep-drawable preforms. Additionally, these TFP preforms allow for processing of natural, glass, aramid, carbon and ceramic fibers which provides for maximum exploitation of reinforcing fibers through uniformly stressed fibers in the composite and near-net-shape production (no cutting, low waste). (See Sect. I., pg. 571) Further the production costs are lowered because of the use of rovings and the high degree of automation making it attractive for series production of preforms for advanced composite parts. (See Sect. I., pg. 571)

As Duval et al. and Mattheij both teach methods for needling/stitching three-dimensional fiber structures, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art to use the TFP method as taught by Mattheij in place of

the needling method as disclosed by Duval et al., for the purpose of producing a preform with stress field aligned fiber placement, 3D-reinforced preforms (full or partial), or deep-drawable preforms all of which are capable of lower production costs thereby obtaining a woven preform of complex shape having improved torsional and shear properties.

10. Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Duval et al. (US 6,183,583) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement) as applied to claim 30 above and further in view of Dietrich (US 6,261,981)

Regarding claim 32, modified Duval et al. discloses all of the claim limitations as set forth above, but the reference does not specifically disclose the structure is siliconized after pyrolyzing.

Dietrich et al. disclose a fiber-reinforced composite ceramic containing high-temperature-resistant fibers based on Si/C/B/N which are reaction-bonded to a matrix based on Si. (See Col 1, lines 5-10) Dietrich et al. also discloses the use of short fiber bundles for reinforcing the composite material results in considerably simplified fiber production, since it is possible to pre-mix the various individual components and press them to form green bodies which subsequently only have to be pyrolyzed and then melt-infiltrated. Favorable properties are obtained by means of silicon melt infiltration when fiber bundles are used for fiber reinforcement. (See Col 2, lines 28-36) The finished composite is suitable for use as brake body or brake disk in high performance brake systems for production motor vehicles or railway vehicles. (See Col 2, lines 57-63)

As modified Duval et al. and Dietrich et al. both relate to fiber-reinforced composites for braking systems, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to replace the preform process steps as disclosed by modified Duval et al. with that of Dietrich et al. in order to simplify further the process of producing the fiber-reinforced composites thereby lowering costs for the mass produced components. (See Col 1, lines 64-67 and Col 2, lines 1-3)

11. Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Duval et al. (US 6,183,583) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement) as applied to claim 30 above and further in view of Hect (US 6,365,257)

Regarding claim 38, modified Duval discloses all of the claim limitations as set forth above. Additionally, Duval et al. discloses manufacturing disk brakes out of C-C composite material, annular fiber preforms are generally made by needling plies of a base fiber fabric comprising a woven cloth or a laminate comprising a plurality of unidirectional sheets of yarns, tows, or strands, optionally associated with a fiber web or a felt. (See Col 2, lines 7-12)

Hect teaches carbon-carbon fiber composites intended for use in applications where severe shear stresses will be encountered, for example, by being subjected to circumferential stress. (See Col 1, lines 30-33) Hect also teaches typically, in needlepunching operations, a portion of the filaments making up the mat will be caught by the barbs and reoriented as filament bundles in the z or thickness

direction. The portion of the filaments not caught by the barbs will be displaced laterally within the x-y plane by the needles. (See Col 12, lines 24-26) The filament bundles created by the needlepunching will vary widely in number of filaments. Additionally, Hect teaches that the method of needlepunching in making preforms having three-dimensional isotropic property characteristics will result in a high strength and densified fiber reinforced composite component (See Col 4, lines 6-8 and 64-67) characterized in that:

- the preform has rovings with thread counts which differ from one another. (See Col 12, lines 29-42, wherein filament bundles are rovings)

It would have been obvious to one of ordinary skill in the art at the time of the invention to use reinforcing fibers in the form of rovings as taught by Hect in the preform of modified Duval et al., for the purpose of maximizing reinforcement effectiveness. (See Col 4, lines 11-15)

12. Claims 42-46, 49, 50, 52, and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Duval et al. (US 6,183,583) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement) as applied to claim 30 above and further in view of Bilisik. (US 6,129,122)

Regarding claims 42-46, 49, 50, 52 modified Duval et al. discloses using layers of felt and bonding them together by needling makes it possible to obtain a structure in which there is no limit on the number of directions in three dimensions in which the fibers are oriented, i.e. a structure is obtained that is genuinely three-dimensional. In

addition, the density of needling can be selected so as to transfer a sufficiently large number of fibers in the Z direction (perpendicular to the layers) to ensure that the resulting structure is of a quasi-isotropic character. (See Col 7, lines 38-46) The modified reference does not specifically disclose the reinforcing fibers extend radially in a layer.

Bilisik discloses a three-dimensional multiaxial circular woven fabric for use as a preform that can be constructed with fiber content in each direction of the preform that is tailored to correspond to the required properties of the preform using a technique that is substantially either the same or equivalent to that of the TFP preform of Mattheij et al. (See Col 2, lines 23-28) The three-dimensional circular woven fabric is oriented multiaxially both in the in-plane and the out-of-plane directions so as to provide high torsional strength, shear strength and high modulus without delaminating. (See Col 2, lines 5-10)

Bilisik further discloses the woven fabric preform for use in complex cross-sectional configured preforms for selected composite applications employing a structure with at least one preform (See Figs. 1-5) having at least one stressable reinforcing fiber layer (See Col 2, lines 6-11, wherein torsional and sheer recite stress) characterized in that:

- the reinforcing fibers extend radially in a layer. (See Fig. 1)
- the reinforcing fibers extend in a circular manner in a layer. (See Fig, 1)
  the reinforcing fibers extend involutely in a layer, (See Fig, 1)

the reinforcing fibers extend in a layer extending from their central opening tangentially (See Fig, 1)

- the reinforcing fibers are placed in such a way that, in a circular preform, the pyrolyzed preform corresponds, or substantially corresponds, in its radial measurement to that of the preform. (See Fig. 1)
- consists of several layers, the layers being placed symmetrically or substantially symmetrically with respect to the central symmetrical plane of the preform in their fiber orientation, (See Fig, 1)
- the preform consists of at least two layers or plies, one of the layers or plies being built from radially placed reinforcing fibers and the remaining layer or ply of reinforcing fibers placed in a circular manner, (See Fig, 1)
- the preform has fibers of the same or essentially the same orientation in its outer surfaces or layers, (See Fig, 3, wherein the same layer 2 is on outer surfaces)

As modified Duval et al. and Bilisik et al. both teach three-dimensional composites, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to arrange the reinforcing fibers in the preform of modified Duval et al. with the fiber orientation as taught by Bilisik, for the purpose of obtaining a woven preform of complex shape having improved torsional and shear properties. (See Col 1, lines 5-11)

Regarding claim 57, it is noted by examiner that the intricate orientation of the yarns as taught by Bilisik would provide for a fleece layer (fabric with a soft deep pile).

As such it would have been within the ordinary skill of one in the art to utilize the teaching to provide for a fleece layer on the outer surface of the composite in place of the friction portion having a crossing of fibers to form a thickening as disclosed by modified Duval et al. thereby additionally increasing the shear properties of the final composite against friction forces.

13. Claim 48 is rejected under 35 U.S.C. 103(a) as being unpatentable over Duval et al. (US 6,183,583) in view of Mattheij et al. (3D Reinforced Stitched Carbon/Epoxy Laminates Made by Tailored Fibre Placement) as applied to claim 30 above and further in view of Berger. (US 3,902,578)

Regarding claim 48, Duval et al. discloses when the resulting C-C composite disk is machined to its final dimensions, it comprises a core (FIG. 1) with a friction portion situated on one side or on both sides of the core depending on whether it is a disk having one friction face or two. Notches (not shown) are formed along the inside or outside periphery of the core so as enable the disk to be connected mechanically to the member with which it is constrained to rotate. (See Col 8, lines 52-59) High-strength carbon fibers are preferably used for the portion of the preform corresponding to the core of the disk since it is the core which transmits friction forces. (See Col 9, lines 6-11) The initial and/or final plies in the stack which correspond to the, or each, friction portion of the disk are then made using a felt of a composition that is different from that forming the intermediate plies which correspond to the core of the disk. (See Col 9, lines 22-26) Modified Duval et al. discloses all of the claim limitations as set forth above but the

reference does not specifically disclose the structure is a clutch disk. However, it is noted by examiner that the friction portion as disclosed by Duval et al. would provide for the composite to also act as a clutch disk.

Berger et al. discloses a friction disk for utilization as either a brake or clutch having a plurality of arcual segments containing a recess in the end portions thereof. A clip joins adjacent arcual segments to form an annulus disk brake or clutch. (See Abstract) The brake disk is preferably made of a plurality of resin impregnated carbon cloth layers. Col 2, lines 37-47) Clips preferably made of steel or a high temperature alloy, join or connect the segments together. (See Col 2, lines 16-17)

As modified Duval et al. and Berger et al. both disclose brake disks, the art is analogous. Therefore, it would have been obvious to one of ordinary skill in the art to utilize the friction surfaces as disclosed by Duval to provide for a clutch brake. Additionally, it would have been obvious to one of ordinary skill at the time of the invention to provide the friction disk as taught by Berger et al. as the friction core of the brake disk as disclosed by Duval et al. making use of the notches provide by the core for the friction portion to connect the two mechanically.

14. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not

commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Conclusion

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ALTREV C. SYKES whose telephone number is (571)270-3162. The examiner can normally be reached on Monday-Thursday, 8AM-5PM EST, alt Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carol Chaney can be reached on 571-272-1254. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/ACS/
7/15/08

/Carol Chaney/
Supervisory Patent Examiner, Art Unit 1794